

REMARKS

Claims 1-162 are pending. Amended are claims 1-2, 4-10, 12-14, 16-17, 23, 25-27, 29-41, 43-47, 49-50, 54, 59, 67, 70, 72-76, 83-84, 89, 92, 95, are 98-101.

1. Rejections under 35 U.S.C. § 102(b) based on Acton et al.:

Claims 1-8, 10, 12-14, 24-41, 44-51, 53, 55-58, 68-85, 88-89, 92, 95, 97-98, 101-107, 109, 114-115, 118-123, 126-132, 134, 139-148, and 150 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Pat. No. 5,544,319 to Acton et al. Applicants respectfully request reconsideration of this rejection.

Claim 1 recites a "memory system" including "a memory controller" and at least one "memory storage device connected to a memory bus." The memory system includes "a continuous optical path coupled to said memory controller and to said memory bus." The optical path is "arranged and configured for exchanging data between said memory controller and said at least one memory storage device."

Acton et al. discloses an optical link between two memory controllers that are used to couple two memory systems together. An electrical link connects each to associated memory modules over an electrical bus. Acton et al. does not disclose or suggest a memory system that includes "a continuous optical path coupled to said memory controller and to said memory bus," the optical path being "arranged and configured for exchanging data between said controller and said at least one memory storage device." Claim 1 is not anticipated or rendered obvious by Acton et al. Claim 1, and its dependent claims 2-8, 10, 12-14, 24-41, and 44, are patentable over the reference to Acton et al.

Claim 45 recites a computer system including, *inter alia*, a memory system connected to a processor. The memory system includes "a memory controller" and "at

least one memory storage device.” The memory system also includes an “optical path coupled at a first end to said memory controller and at a second end to a bus connecting with said at least one memory storage device for optically exchanging data between said memory controller and said at least one memory storage device.”

Acton et al. discloses an optical link, but only between two memory coupling controllers. Acton et al. does not disclose or suggest a memory system that includes an “optical path coupled at a first end to said memory controller and at a second end to a bus connecting with said at least one memory storage device for optically exchanging data between said memory controller and said at least one memory storage device.” Claim 45 is not anticipated or rendered obvious by Acton et al. Claim 45, and its dependent claims 46-51, 53, 55-58, 68-85, and 88 , are patentable over the reference to Acton et al.

Claim 89 recites an electro-optical converter for a memory system that includes “at least one input arranged and configured to receive an electrical data signal from a memory controller,” and “at least one device arranged and configured to convert said electrical data signal to an optical signal.” At least one optical output is “arranged and configured to transmit said optical signal into an optical path coupled directly to a memory module.”

Acton et al. teaches long-distance optical links between two memory controllers. Acton et al. does not teach or suggest a converter for a memory system that has an optical output “arranged and configured to transmit said optical signal into an optical path coupled directly to a memory storage device.” Claim 89 is patentable over Acton et al.

Claim 92 recites an electro-optical converter for a memory system that includes “at least one input arranged and configured to receive an electrical data signal from at least one memory storage device,” and “at least one device arranged and configured to convert said data signal to an optical signal.” The memory system also includes “at least one optical output arranged and configured to transmit said optical signal into an optical path connected directly to a memory controller.”

Acton et al. discloses optical links between memory controllers. Acton et al. does not teach or suggest “at least one input arranged and configured to receive an electrical data signal from at least one memory storage device,” “at least one device arranged and configured to convert said data signal to an optical signal,” and also “at least one optical output arranged and configured to transmit said optical signal into an optical path.” Claim 92 is patentable over Acton et al.

Claim 95 recites an electro-optical converter for a memory system comprising “at least one input arranged and configured to receive an optical data signal from an optical path coupling said at least one input directly to a memory module.” At least “one electro-optical converter is arranged and configured to convert said received data signal to an electrical signal.” At least “one electrical output is arranged and configured to transmit said output signal to an electrical path of a memory controller.”

Acton et al. discloses optical coupling of memory controllers. Acton et al. does not teach or suggest a converter for a memory system that has “at least one input arranged and configured to receive an optical data signal from an optical path coupled to a memory storage device.” Claim 95 and its dependent claim 97 are patentable over Acton et al.

Claim 98 recites a memory system comprising “a memory module having at least one input arranged and configured to receive an optical data signal from an optical path connecting directly between said at least one input and a memory controller,” and “at least one electro-optical converter arranged and configured to convert said received optical data signal received by said at least one input to an electrical signal.” The memory system also includes at least “one electrical output arranged and configured for transmitting said output electrical signal to an electrical path of a memory storage device.”

Acton et al. discloses two memory controllers that communicate over optical links. Acton et al. does not teach or suggest a memory system that features “a memory module having at least one input arranged and configured to receive an optical data signal from an optical path connecting directly between said at least one input and a memory controller,” and “at least one electrical output arranged and configured to transmit said electrical signal to an electrical path of a memory storage device.” Claim 98 is patentable over Acton et al.

Claim 101 recites a method of operating a memory system comprising “receiving electrical signals from a memory controller,” and “converting said received electrical signals into optical signals.” The method also includes “transmitting said optical signals over an optical path directly to a memory module.”

Acton et al. discloses transmitting optical signals over long distances between two memory controllers. Optical signal transmitted takes place only between the two memory controllers. Acton et al. does not teach or suggest “transmitting said optical signals over an optical path directly to a memory module” as recited in claim 101. Claim 101 and its dependent claims 102-107, 109, 114-115, 118-123, and 125 are patentable over Acton et al.

Claim 126 recites a method of operating a memory system comprising “receiving electrical signals from at least one memory storage device,” “converting said received electrical signals into optical signals,” and “transmitting said optical signals over an optical path to a memory controller controlling said at least one memory storage device.”

Acton et al. transmits optical signals between two controllers. The *only* optical signal transmission is between the two controllers. Electrical signal transmission occurs between a controller and a memory storage device. The transmission of optical signals from one controller to another in Acton et al. does not teach or suggest a memory system operated by “receiving electrical signals from at least one memory storage device,” “converting said received electrical signals into optical signals,” and “transmitting said optical signals over an optical path to a memory controller controlling said at least one memory storage device.” Even if one characterizes Acton et al. as disclosing a first controller at which the electrical signals are received and converted to optical signals that are sent to a second controller, the first controller, not the second controller, is “controlling said at least one memory device.” Claim 126 and its dependent claims 127-132, 134, 139-148, and 150 are patentable over Acton et al.

2. Rejections under 35 U.S.C. § 103(a) based on Acton et al. in view of Fee:

Claims 9, 15-23, 42-43, 52, 59-67, 86-87, 108, 111-113, 124-125, 133, 136-138, 149, 152-154, 156-158, and 160-162 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Acton et al. in view of U.S. Pat. No. 6,658,210 to Fee. Applicants respectfully request reconsideration of this rejection.

Claims 9, 15-23, 42, 43, and 151-154 depend from 1. Claim 1 is patentable over Acton et al. Fee has not been cited against claim 1. If Fee were properly cited against claim 1, the combination would not produce the invention recited by claim 1. Fee discloses a bidirectional optical communications system. Multiplexed signals are amplified and transmitted over a single optical fiber provided with a bidirectional amplifier. The signals are multiplexed in order to avoid interference. Fee does not suggest modifying the disclosure of Acton et al. to provide "a continuous optical path coupled to said memory controller and to said memory bus arranged and configured for exchanging data between said memory controller and said at least one memory storage device." Claim 1 and its dependent claims 2-44 and 151-154 are patentable over the combination of cited references to Acton et al. and Fee.

Claims 52, 59-67, 86-87, and 156-158 depend from claim 45. Claim 45 is patentable over Acton et al. Fee has not been cited against claim 45, and in any event would not combine with Acton et al. to establish *prima facie* obviousness. Neither Acton et al. nor Fee contains any suggestion of providing an "optical path coupled at a first end to said memory controller and at a second end to a bus connecting with said at least one memory storage device for optically exchanging data between said memory controller and said at least one memory storage device." Moreover, any motivation to make the modifications necessary could only come from an improper hindsight attempt to reconstruct the present invention. Claim 45 and its dependent claims 46-88 and 155-158 are patentable over the combination of cited references to Acton et al. and Fee.

Claims 108, 111-113, 124-125, and 160-162 depend from claim 101. Claim 101 is patentable over Acton et al. Fee has not been cited against claim 101. Even if Fee had been properly cited against claim 101, the proposed combination with Acton et al. would not establish *prima facie* obviousness. The inventive method of claim 101 includes "transmitting said optical signals over an optical path directly to a memory

module.” Fee provides no teaching, motivation, or suggestion for replacing the electrical memory coupling buses of Acton et al. to allow “transmitting said optical signals over an optical path directly to a memory module.” Further, the requisite motivation to do so is absent from the references, and could only come from applicants’ disclosure in an improper hindsight attempt to reconstruct the present invention. Claim 101 and its dependent claims 108, 111-113, 124-125, and 160-162 are patentable over the proposed combination of Acton et al. and Fee.

Claims 133, 136-138, and 149 depend from claim 126. Claim 126 is patentable over Acton et al. Fee has not been cited against claim 126, and even if properly cited would not combine with Acton et al. to render claim 126 *prima facie* obvious. Claim 126 recites a method of operating a memory system that includes “receiving electrical signals from at least one memory storage device,” and “transmitting said optical signals over an optical path to a memory controller controlling said at least one memory storage device.” These features are missing from Acton et al., which communicates optically between two fiber-to-memory coupling system controllers, but not between a memory controller and a memory storage device. Fee discloses an optical communication system, and provides no suggestion or motivation for replacing the electrical memory coupling bus of Acton et al. with optical communication links, as would be necessary to carry out the method recited in claim 126. Any motivation to make the modifications necessary comes from applicants in an improper hindsight attempt to reconstruct the present invention. Claim 126 and its dependent claims 133, 136-138, and 149 are patentable over the proposed combination of Acton et al. and Fee.

3. Rejections under 35 U.S.C. § 103(a) based on Acton et al. in view of Copeland:

Claims 11, 54, 72, 90-91, 93-94, 96, 99, 100, 110, 116-117, 135, 142, 151, 155, and 159 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Acton '319 in view of U.S. Pat. No. 6,782,209 to Copeland. Applicants respectfully request reconsideration of this rejection.

Claims 11 and 151 depend from claim 1. Claim 1 is patentable over Acton et al. Copeland has not been cited as a reference against claim 1. Even if Copeland had been properly cited against claim 1, the proposed combination would not render claim 1 *prima facie* obvious. Copeland discloses an optical communications system. Copeland does not combine with Acton et al. to provide a memory system having "a continuous optical path coupled to said memory controller and to said memory bus arranged and configured for exchanging data between said memory controller and said at least one memory storage device." Motivation to combine the two references and make the required modifications comes only from applicants' teachings in an improper hindsight attempt to reconstruct the present invention. Claim 1, and its dependent claims 11 and 151 are patentable over the proposed combination of references to Acton et al. and Copeland.

Claims 54, 72, and 155 depend from claim 45. Claim 45 is patentable over Acton et al. Copeland has not been cited as a reference against claim 45, and even if properly cited would not render claim 45 *prima facie* obvious. Copeland discloses an optical communications system. Copeland does not serve to modify Acton et al. to provide a memory system that includes an "optical path coupled at a first end to said memory controller and at a second end to a bus connecting with said at least one memory storage device for optically exchanging data between said memory controller and said at least one memory storage device." Moreover, the motivation to do so is not found in the references, and comes only as part of an improper hindsight attempt to

reconstruct the present invention. Claim 45, and its dependent claims 54, 72, and 155 are patentable over Acton et al. and Copeland combined.

Claims 90 and 91 depend from claim 89. Claim 89 is patentable over Acton et al. Copeland has not been cited as a reference against claim 89, and had it been would not render claim 89 obvious. Copeland teaches an optical communications system. Copeland does not serve to modify Acton et al. to provide an electro-optical converter for a memory system that includes "at least one input arranged and configured to receive an electrical data signal from a memory controller," "at least one device arranged and configured to convert said electrical data signal to an optical signal," and at least one optical output "arranged and configured to transmit said optical signal into an optical path coupled directly to a memory module." Being absent from the references, motivation to do so comes only as part of an improper hindsight attempt to reconstruct the present invention using the prior art. Claim 89 is patentable over the proposed combination of references to Acton et al. and Copeland. Claims 90 and 91 depend from claim 89, and are patentable over Acton et al. in view of Copeland for at least the same reasons.

Claims 93 and 94 depend from claim 92. Claim 92 is patentable over Acton et al. Copeland has not been cited as a reference against claim 92. Claim 92 recites an electro-optical converter for a memory system that includes "at least one input arranged and configured to receive an electrical data signal from at least one memory storage device," "at least one device arranged and configured to convert said data signal to an optical signal," and "at least one optical output arranged and configured to transmit said optical signal into an optical path connected directly to a memory controller." The optical communications device disclosure of Copeland does not serve to modify Acton et al. as would be necessary to arrive at the present invention. Moreover, motivation to do so comes from applicants' disclosure as part of an

improper hindsight attempt to reconstruct the present invention. Claim 92 is patentable over the proposed combination of Acton et al. and Copeland. Claims 93 and 94 depend from claim 92, and are patentable over Acton et al. in view of Copeland for at least the same reasons.

Claim 96 depends from claim 95. Claim 95 is patentable over Acton et al. Copeland has not been cited as a reference against claim 95. Claim 95 recites an electro-optical converter for a memory system comprising "at least one input arranged and configured to receive an optical data signal from an optical path coupling said at least one input directly to a memory module," where at least "one electro-optical converter is arranged and configured to convert said received data signal to an electrical signal," and at least "one electrical output is arranged and configured to transmit said output signal to an electrical path of a memory controller." Copeland's disclosure of an optical communications system does not serve to modify Acton et al. as would be necessary to render claim 95 obvious. Moreover, any motivation to do so comes not from the references, but rather from an improper hindsight attempt to reconstruct the present invention. Claim 95 is patentable over the proposed combination of Acton et al. and Copeland. Claim 96 depends from claim 95, and is patentable over the combined references to Acton et al. and Copeland for at least the same reasons.

Claims 99 and 100 depend from claim 98. Claim 98 is patentable over Acton et al. Copeland has not been cited as a reference against claim 98. Even if Copeland had been properly cited against claim 98, *prima facie* obviousness would not have been established. Claim 98 recites a memory system comprising "a memory module having at least one input arranged and configured to receive an optical data signal from an optical path connecting directly between said at least one input and a memory controller," "at least one electro-optical converter arranged and configured to convert said received optical data signal received by said at least one input to an electrical

signal,” and at least “one electrical output arranged and configured for transmitting said output electrical signal to an electrical path of a memory storage device.” These features, which are missing from Acton et al., are not disclosed or suggested by Copeland. In addition, Copeland provides no suggestion or motivation for modifying the disclosure of Acton et al. to achieve the invention recited in claim 98. Any such suggestion or motivation comes improperly from applicants’ disclosure. Claim 98 is patentable over the proposed combination of the Acton et al. and Copeland references. Claims 99 and 100 depend from claim 98, and are patentable over Acton et al. in view of Copeland for at least the same reasons.

Claims 110, 116, 117, and 159 depend from claim 101. Claim 101 is patentable over Acton et al. Copeland has not been cited against claim 101, and in any event would not serve to render claim 101 *prima facie* obvious. Acton et al. does not teach or suggest the method of claim 101 which includes operating a memory system by “receiving electrical signals from a memory controller,” “converting said received electrical signals into optical signals,” and “transmitting said optical signals over an optical path directly to a memory module.” The optical communications system disclosed by Copeland does not cure the deficiencies of Acton et al. Copeland has nothing to do with memories, and does not serve to selectively replace the memory communications nodes disclosed by Acton et al. with fiber optic links. Moreover, any motivation to do so comes only from applicants’ disclosure. Claim 101 is patentable over the proposed combination of Acton et al. and Copeland. Claims 110, 116-117, and 159 depend from claim 101, and are patentable over the combined references to Acton et al. and Copeland for at least the same reasons.

Claims 135 and 142 depend from claim 126. Claim 126 is patentable over Acton et al. Copeland has not been cited against claim 126, and would not render obvious claim 126 in any event. Acton et al. fails to teach or suggest features of claim

126, which recites a method of operating a memory system comprising "receiving electrical signals from at least one memory storage device," "converting said received electrical signals into optical signals," and "transmitting said optical signals over an optical path to a memory controller controlling said at least one memory storage device." The communications system disclosure of Copeland does not cure the deficiencies of Acton et al. There is no motivation in the cited references to modify Acton et al. to produce a system that receives "electrical signals from at least one memory device," converts them into "optical signals," and transmits the "optical signals over an optical path to a memory controller" that controls the memory storage device. Claim 126 is patentable over the proposed combination of Acton et al. and Copeland. Claims 135 and 142 depend from claim 126 and are patentable over Acton et al. in view of Copeland for at least the same reasons.

In view of the above amendment and remarks, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

By 

Thomas J. D'Amico

Registration No.: 28,371

DICKSTEIN SHAPIRO MORIN &
OSHINSKY LLP

2101 L Street NW

Washington, DC 20037-1526

(202) 785-9700

Attorney for Applicant